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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/600,945	06/20/2003	Howard Davidson	5181-83401/EBM	9468

35690 7590 07/22/2004

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EXAMINER

NGUYEN, HA T

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 07/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/600,945

Applicant(s)

DAVIDSON, HOWARD

OK

Examiner

Ha T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 May 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-19,22-30 and 32-36 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14-19,22-30,32-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Notice to applicant

1. Applicant's Amendment and Response to the Office Action mailed 02-27-04 has been entered and made of record.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 14, 19, 22-24, 32, 35, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishibayashi (USPN 6171691) in view of Klett et al.'s "Carbon foam for electronic cooling" (hereinafter "Klett").

Referring to Figs. 1-19 and related text, Nishibayashi discloses [Claims 14 and 32] a method of coupling a carbon material to an integrated circuit comprising: coating a carbon material with first solder 2; and coupling the carbon material coated with first solder to the integrated circuit such that thermal energy from the integrated circuit is transferred to the carbon material (see Fig. 19). But Nishibayashi does not disclose expressly the use of carbon foam. However, the missing limitation is well known in the art because Klett discloses this feature (See p. 22, "Passive evaporative cooling"). A person of ordinary skill is motivated to modify Nishibayashi with Klett to obtain device using good thermal conductive heat sink at a lower price.

[Claim 19] Nishibayashi also discloses coating a surface of the carbon material with a second solder; [Claim 22] wherein a second solder, and wherein the second solder comprises copper, nickel, gold, silver, lead, silicon, indium, bismuth, titanium, tin, or mixtures thereof; [Claim 36] wherein the solder comprises a reactive braze alloy. (see col. 6, lines 47-62). But the combined teaching does not teach coating the surface of the integrated circuit with a second

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solder and [Claim 23] wherein coupling the carbon foam material to the integrated circuit comprises coupling the integrated circuit and the carbon foam material with a universal solder. However it would have been obvious for a person of ordinary skill to either coat the second solder on the carbon material or on the integrated circuit to couple the integrated circuit and the carbon foam material since the result would be the same, and using universal solder for coupling since this is commonly used in the art. [Claim 24] It is also well known in the art that adhesive is used to couple 2 materials together, including coupling an integrated circuit with a heat sink.

[Claim 35] Nishibayashi discloses a thick layer or solder that infiltrates and enveloping each particle of carbon material (see Fig. 4). In the combined teaching of Nishibayashi and Klett this would correspond to a depth solder applied to the carbon foam comprising at least two carbon foam ligament diameters into a body of the carbon foam material.

Therefore, it would have been obvious to combine Nishibayashi with Klett to obtain the invention as specified in claims 14, 19, 22-24, 32, 35, and 36.

4. Claims 15-18, 27-30, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishibayashi (USPN 6171691) in view of Klett, as applied above, and further in view of Colella et al. (USPN 5783316, hereinafter "Colella").

The combined teaching of Nishibayashi and Klett discloses substantially the limitations of claims 15-18, as shown above. But it does not disclose expressly [Claim 15] cleaning a surface of the integrated circuit; [Claim 16] cleaning a surface of the integrated circuit by back sputtering the surface of the integrated circuit with an inert gas; [Claim 17] cleaning a surface of the carbon foam material; [Claim 18] cleaning a surface of the carbon foam material by backsputtering with an inert gas. However, the missing limitation is well known in the art because Colella discloses the sputtering cleaning of the carbon material with He plasma (See col. 5, lines 8-54). Even though, the combined teaching of the applied references do not teach cleaning the integrated circuits. It would have been obvious to do the same for the integrated circuits.

[Claims 27-30 and 33] Colella also discloses the formation of the carbon material in a vacuum furnace, using heat (see Figs. 1 and 4C). But the combined teaching does not teach coupling integrated circuit with the carbon foam material by heating in an inert atmosphere

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furnace, reducing atmosphere furnace, or on a hot plate. However this would have been obvious for a person of ordinary skill in the art in order to protect against contamination and oxidation, using inert or reducing environment would be appropriate to ensure reliable bonding. Besides, hot plate is commonly used in the art to heat substrate.

A person of ordinary skill is motivated to modify Nishibayashi and Klett with Colella to obtain better adhesion of the carbon material to the integrated circuits.

Therefore, it would have been obvious to combine Nishibayashi and Klett with Colella to obtain the invention as specified in claims 15-18, 27-30, and 33.

5. Claims 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable Nishibayashi in view of Klett, as applied above, and further in view of Ohsaki (USPN 6198143).

The combined teaching of Nishibayashi and Klett discloses substantially the limitations of claims 25 and 26, as shown above.

But it does not disclose expressly comprising forming a silicide on a surface of the integrated circuit; and coating a surface of the silicide with an adherent metal.

However, the missing limitations are well known in the art because Ohsaki discloses these features (See Fig. 5F, # 13,11).

A person of ordinary skill is motivated to modify Nishibayashi and Klett with Ohsaki to obtain simpler and better adhesion with a silicon containing integrated circuit .

Therefore, it would have been obvious to combine Nishibayashi and Klett with Ohsaki to obtain the invention as specified in claims 25 and 26.

6. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nishibayashi in view of Klett and Colella, as applied above, and further in view of Kajiwara et al. (JPN 62-29151, hereinafter "Kajiwara").

The combined teaching of Nishibayashi, Klett, and Colella discloses substantially the limitations of claim 34, as shown above.

But it does not disclose expressly details about the heat exchange fluid.

However, the missing limitation is well known in the art because Kajiwara discloses this feature (See Fig. 2 and constitution).

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A person of ordinary skill is motivated to modify Nishibayashi, Klett, and Colella with Kajiwara to obtain efficient cooling effect.

Therefore, it would have been obvious to combine Nishibayashi, Klett, and Colella with Kajiwara to obtain the invention as specified in claim 34.

Response to Amendment

7. Applicant's arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicant argued that combining Nishibayashi (USPN 6171691) with Klett et al.'s "Carbon Foam for Electronics Cooling" (hereinafter "Klett") "would change the principle operation of Nishibayashi" and that "Nishibayashi teaches away from using graphite foam material". The examiner disagreed, in combining Nishibayashi with Klett the advantages of lighter weight and smaller size provided by the carbon foam are obtained. In the combined teaching the carbon foam would be made from diamond particles, as taught by Nishibayashi not from graphite particles, diamond and graphite are two forms of carbon, a person of ordinary skills would use the appropriate form of carbon to obtain the desired objective, in this case good thermal conductivity.

Applicant argued that there is no motivation to combine Nishibayashi with Klett, the examiner disagreed, as stated in the rejection the motivation is to obtain "good thermal conductive heat sink at a lower price", when the heat sink has good thermal conductivity and is smaller (see Klett, Introduction) the device would cost less. The expectation of some advantage is the strongest rationale for combining references (MPEP 2144).

Applicant argued that Nishibayashi does not appear to teach or suggest the use of solder. The examiner disagreed, as clearly shows in Example 1, metal 2a is a solder, even though Nishibayashi does not explicitly disclose that metal 3a in Fig. 6 is also a solder, however a person of ordinary skills in the art would interpret that metal 3a is also a solder or at least it would have been obvious for a person of ordinary skills to use a solder for metal 3a because solder would reduce the lower melting temperature.

USPN 6008071 to Karasawa et al., 6251766 to Desai et al., and 6211571 to Zakel et al. are cited to support the examiner's statement concerning the well known nature of the

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deposition of solder on an integrated circuit (chip) for bonding to a substrate including substrate comprising carbon.

Therefore, the applied references do teach or make obvious all the limitations of the rejected claims.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Neibling, can be reached on (571) 272-1679. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen
Primary Examiner

07-19-04